Enterprise-wide Drug-Drug Interaction Alerting System

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Introduction According to the Institute of Medicine's (IOM) 1999 report *To Err is Human: Building a safer Health System*, "medical errors kill some 44,000-98,000[1] people in U.S. hospitals each year. Partners HealthCare System (PHS) is a large integrated delivery network in Boston, MA, which has as a goal improving patient care by preventing adverse drug events (ADE) and reducing medication errors enterprise-wide. PHS has developed a drug-drug Interaction (DDI) detection feature, for the suite of clinical applications currently used by its two major teaching institutions, Brigham & Women's Hospital (BWH) and Mass General Hospital (MGH).

The following clinical applications will be using this drug-drug interaction feature: NICU Order Entry (OE) at BWH, MGH OE for pediatrics and adults, the Partners outpatient medical record, The LMR, and BICS OE at BWH.

System Components

Partners wide Drug-drug Knowledge Base (KB)- The knowledge base currently consists of approximately 629 active DDI's. The Partners DDI Content Committee reviews and approves DDI's provided by First Databank and decides on the level of severity. The DDI Content Committee consists of pt. safety, clinical, pharmacy, and informatics personnel. They also decided that alerts needed to have three tiers of notification: hard stops, interruptive and non-interruptive. A hardstop alert will not allow the user to order the combination of medications. The ordering clinician will need to discontinue one of the medications prior to proceeding. An interruptive alert allows the user to "acknowledge" the alert, then continue with the ordering process. For interruptive alerts, the user is given the option to keep or cancel the order. If the user keeps the order, they will need to enter a coded override reason in order to continue. At this time, the system allows the user the opportunity to order (consequent) follow-up lab tests if indicated for monitoring purposes. Sixty Four Percent of the DDI's are interruptive. A non-interruptive alert displays alerting text on the screen to inform the user that a DDI has occurred, but doesn't require an explicit action to acknowledge the information has been viewed. This alerting process is informational to the user

1. **Inferencing Algorithm-** The inferencing algorithm gives the applications the ability to address subsequent lab ordering in relation to a generated alert. The DDI checking service is called when a new medication is ordered. The new medication is compared with the active medication list to determine whether an interaction exists from the interacting pair. Lab values are included in the logic, For example if a medication is ordered for Spirolactone, the application will check the K+ level of the patient within the last 72 hours, and will only alert if greater than 5.
2. **User Interface (UI)-** The web-based UI provides the applications, using the service, with a structure for determining level of alerts, consistent screen layout, and common warnings across all sites. Multiple alerts could trigger during an ordering session and alerts would display in a hierarchical sequence.
3. It also allows for consequent ordering, so it gives the user the opportunity to order a lab with the medication. For example, if Erythromycin is ordered, a consequent order for digoxin level will be offered.
4. **DDI Logging-** after a DDI has been found and an action taken, this service allows the actions taken by the user, to be logged into a common repository so that the information can be used for future research and evaluation.

Current Status

Presently, the BWH NICU OE has been using the DDI alert system since October 2002. From October 2002 to March 2003, there have been a total of 91 DDI alerts triggered in the BWH NICU. More than 50% of these DDI alerts required override reasons. A small set of medications account for the majority of NICU orders, and in general these do not interact. Further statistical analysis of usage, is currently underway. MGH OE will be next application to "go-live" with the DDI service.

Conclusion

Adverse drug events within health care systems, has gained enormous publicity over the past several years. Partners HealthCare System continues to develop decision support within their clinical information systems, in order to continue to provide the highest quality of care in regards to patient safety.

References

1. Kohn L, Corrigan J, Donaldson M. To err is human: building a safer health system. Institute of Medicine Committee on Quality of Health Care in America. Washington: National Academy Press: 2001.